

**UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:19-cv-12551-FDS

Hon. F. Dennis Saylor IV

REDACTED VERSION

**PLAINTIFF'S OPPOSITION TO DEFENDANT'S MOTION
FOR FURTHER CLAIM CONSTRUCTION**

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Plaintiff, Singular Computing LLC (“Singular”), respectfully submits this memorandum of law in opposition to the motion of defendant, Google LLC (“Google”), for the Court to engage in further claim construction. For the reasons set forth below, the motion should be denied.

I. INTRODUCTION

Less than two months before trial, Google makes an extremely untimely request to revisit claim construction, now suggesting a construction it never before proposed, and presuming without basis that its new claim construction will end the case. Google’s proposed construction should be rejected because it is far too late, is unsupported by the intrinsic or extrinsic evidence, and impermissibly imports an extraneous limitation into the claims. *See, e.g., Phillips v. AWH Corp.*, 415 F.3d 1303, 1323-25 (Fed. Cir. 2005).

II. LEGAL STANDARDS

District courts have discretion to preclude parties from injecting new claim-construction theories after the deadline for claim construction procedures has passed. *Bettcher Indus. Inc. v. Bunzl USA, Inc.*, 661 F.3d 629, 640-41 (Fed. Cir. 2011); *see also SanDisk Corp. v. Memorex Prods., Inc.*, 415 F.3d 1278, 1292 (Fed. Cir. 2005). A defendant “waive[s] any argument with respect to [a] term by failing to raise it during the claim construction phase.” *Cent. Admixture Pharm. Servs., Inc. v. Advanced Cardiac Sols., P.C.*, 482 F.3d 1347, 1356 (Fed. Cir. 2007); *see also Abiomed, Inc. v. Maquet Cardiovasc. LLC*, 566 F. Supp.3d 59, 74 (D. Mass. 2021).

The claims of a patent define the scope of the invention to which the patentee is entitled to exclude. *Phillips v. AWH*, 415 F.3d at 1312. The specification is “always highly relevant to the claim construction analysis.” *Id.* at 1315. Courts must be careful to “us[e] the specification [only] to interpret the meaning of a claim” and not to “import[] limitations from the specification into the claim.” *Id.* at 1323. The Federal Circuit has “expressly rejected the contention” that the

claims must be limited to the embodiment(s) disclosed in the specification. *Id.* The “outer boundary of claims is set by the patentee’s description of his invention.” *On Demand Mach. Corp. v. Ingram Indus., Inc.*, 442 F.3d 1331, 1338 (Fed. Cir. 2006).

III. ARGUMENT

A. GOOGLE’S REQUEST FOR FURTHER CLAIM CONSTRUCTION IS UNTIMELY AND HAS BEEN WAIVED

Google raised the “further” claim construction issue that is the subject of the present motion with counsel for Singular for the first time on October 26, 2023. *See* Ex A.¹

The Court issued the Scheduling Order in this case over three years ago, on July 27, 2020. *See* Dkt. No. 59. The Order included a schedule for claim construction briefing and set the *Markman* hearing for March 31, 2021. *Id.* at 2-3. Google filed its opening brief on January 8, 2021, more than two years ago, *see* Dkt. No. 112, and its reply to Singular’s opening brief on February 8, 2021. *See* Dkt. No. 134. The parties filed the Join Claim Construction Brief on February 22, 2021. *See* Dkt. No. 138. Google filed a supplemental claim construction brief on March 15, 2021. *See* Dkt. No. 146. The *Markman* hearing took place on March 31, 2021, well over two years ago. Thereafter, Google filed a Post-*Markman* claim construction brief. *See* Dkt. No. 157. In none of its four claim construction briefs did Google request the claim construction addressed in its present motion. On July 27, 2022, more than 15 months ago, the Court issued its Claim Construction Order resolving all claim construction disputes between the parties. *See* Dkt. No. 354. The parties then proceeded to pursue and complete expert discovery based upon those constructions, including service of Singular’s expert’s report more than ten months ago on

¹ Unless otherwise noted, all exhibits referenced herein are attached to the accompanying Declaration of Kevin Gannon.

December 22, 2022. The Court denied Google's motion for summary judgment of non-infringement on July 18, 2023, more than three months ago.

Based upon those constructions, the case is now ready for trial and scheduled to begin in less than two months.

Google provides no credible reason why it waited until now to raise this issue, more than two years after it adopted and argued its position on claim construction, more than 15 months after the Court's ruling on claim construction, and well more than three months after this Court's denial of Google's motion for summary judgment of non-infringement. Google's purported reason – allegedly becoming aware of Singular's infringement theory from Singular's expert report of Dr. Khatri – happened almost a year ago in December 2022. Even accepting Google's reason at face value (which, for the record, Singular does not), Google chose not to address its alleged pressing need for a “new” claim construction until now, and instead decided to serve its own expert's report, *and* move for summary judgment of non-infringement on April 28, 2023 (Dkt. No. 460), four months after it had received the Khatri report, all *based on the Court's original claim construction*.

As set forth above, district courts have discretion to preclude parties from injecting new claim-construction theories after the deadline for claim construction procedures has passed. *Bettcher v. Bunzl*, 661 F.3d at 640-41; *see also SanDisk v. Memorex*, 415 F.3d at 1292. Thus, a defendant “waive[s] any argument with respect to [a] term by failing to raise it during the claim construction phase.” *Cent. Admixture v. Advanced Cardiac*, 482 F.3d at 1356. In *Abiomed v. Maquet*, the defendant belatedly moved for additional claim construction, as Google does here. This Court ruled as follows:

Here, the Court ordered the parties to submit their opening claim-construction briefs by December 15, 2017. Reply briefs were filed on January 26, 2018. After a two-day hearing, the Court issued its memorandum and order on claim construction on September 7, 2018, construing eighteen terms or groups of terms. On May 22, 2019, it denied Maquet's motion seeking reconsideration of one the claim term groups. Abiomed thus had ample opportunity to raise its contention of prosecution disclaimer of the subject matter in question, and did in fact raise contentions of prosecution disclaimer as to other terms. Accordingly, the Court agrees that to the extent not already raised, Abiomed has waived any contentions as to prosecution disclaimer that affect the construction of claims.

Abiomed v. Maquet, 566 F. Supp.3d at 74.

As is readily apparent from the multiple claim construction briefs it filed over one-and-a-half years ago, and as in *Abiomed*, Google had “ample opportunity” to timely request the “further” claim construction it now seeks on the eve of trial. As in *Abiomed*, and many other cases², Google should not be given an extremely belated second bite at the claim construction apple:

[W]here a court has prescribed specific claim construction procedures and the parties have proceeded towards trial in reliance thereon, the court has discretion to preclude parties from injecting new claim construction theories on the eve of trial.

Music Choice v. Stingray Dig. Grp., Inc., No. 2:16-cv-00586, 2019 WL 8110069, at *3 (E.D. Tex. Nov. 19, 2019) (denying supplemental construction) (citation omitted); *see also Parker-Hannifin Corp. v. Wix Filtration Corp.*, No. 1:07 CV 1374, 2009 WL 10689385, at *12 (N.D. Ohio Nov. 6, 2009); *Newriver, Inc. v. Mobular Techs., Inc.*, No. 05 CV 12285, 2008 WL 11388611, at *2 (D. Mass. Dec. 15, 2008). Google's election to proceed with expert discovery

² *See, e.g., DNA Genotek, Inc. v. Spectrum Solutions LLC*, No. 3:21-CV-00516, 2023 WL 3445207, at *7 (S.D. Cal. May 2, 2023); *Contour IP Holding, LLC v. GoPro, Inc.*, No. 3:17-cv-04738, 2020 WL 5106845 (N.D. Cal. Aug. 31, 2020); *Hunter Douglas Inc. v. Great Lake Woods, Inc.*, 2019 WL 1375675, at *11 (D. Colo. Mar. 27, 2019); *Prisua Eng'g Corp. v. Samsung Elecs. Co. Ltd.*, No. 1:16-cv-21761, 2018 WL 11352591, at *6 (S.D. Fla. Feb. 15, 2018); *Elbit Sys. Land and C4I Ltd. v. Hughes Network Sys., LLC*, No. 2:15-CV-00037, 2017 WL 2651618, at *8 (E.D. Tex. Jun. 20, 2017); *Advanced Steel Recovery, LLC v. X-Body Equip., Inc.*, No. 2:12-cv-1004, 2014 WL 3939356, at *4 (E.D. Cal. Aug. 11, 2014), *aff'd*, 808 F.3d 1313 (Fed. Cir. 2015).

and a summary judgment motion based upon the Court’s original construction is a clear waiver of further bites at the claim construction apple. *See, e.g., Spigen Korea Co. Ltd. v. Ispeaker Ltd.*, No. CV 16-8559, 2018 WL 6038300, at *18 (C.D. Cal. Jul. 16, 2018), *aff’d*, 801 Fed. Appx. 777 (Fed. Cir. 2020).

With trial scheduled to begin on January 5, 2023, the prejudice to Singular should Google’s present request be entertained is self-apparent; expert reports will have to be amended; experts and other witnesses will need to be re-deposed; trial preparation will need to be revised etc. All of this could have been avoided had Google requested the construction it now requests when it should have. Such prejudice alone warrants denying the present motion.

B. GOOGLE’S PROPOSED CLAIM CONSTRUCTION SHOULD BE REJECTED

Google’s proposed construction should be rejected as improper for at least the reasons set forth below.

Google requests the Court to add a new restrictive limitation to the Court’s prior construction of “execution unit,” namely a “processing element comprising an arithmetic circuit paired with a memory circuit.” *See* Claim Construction Order (Dkt. No.354 at 25). More particularly, Google asserts that the new construction of “execution unit” should now be a “*physically distinct* processing element comprising an arithmetic circuit paired with a memory circuit.” *See* Mot. at 2 (highlight by Google). The highlighted words are the new additional restrictive limitation that Google improperly seeks to inject into the currently governing construction of “execution unit.”

As the Federal Circuit has repeatedly admonished, “Courts do not rewrite claims; instead, [courts] give effect to the terms chosen by the patentee.” *K–2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1364 (Fed. Cir. 1999); *see also Taurus IP, LLC v. DaimlerChrysler Corp.*, 726 F.3d 1306,

1321 (Fed. Cir. 2013). Google’s addition of the “physically distinct” limitation would plainly rewrite the claims .

1. Ordinary Meaning Requires Rejection of “Physically Distinct”

Courts begin with ordinary meaning of claim terms. The ordinary meaning of “unit” supports the Court’s current claim construction, and requires rejection of Google’s “physically distinct” proposal.

Definitions of “unit” suggest that while units can be considered individual or distinct for purposes of measurement, analysis, or functionality (*e.g.*, a reduced precision operation), they do not necessarily have to be physically separate entities. Merriam-Webster defines a unit as “a single thing, person, or group that is a constituent of a whole” or “a piece or *complex of apparatus serving to perform one particular function.*” *See* Ex. B (emphasis added).

Dictionary.com offers a definition that includes “any group or individual, esp. when regarded as a basic element of a larger whole” or “a machine, part, or *system of machines having a specified purpose; apparatus.*” ” *See* Ex. C (emphasis added). The Britannica Dictionary describes a unit as “a single thing, person, or group that is a part of something larger” or “a machine or *part of a machine or system that has a particular use.*” *See* Ex. D (emphasis added). Oxford Learner’s Dictionaries state a unit can be “a single thing, person or group that is complete by itself but can also form part of something larger” or “a small *machine that has a particular purpose* or is part of a larger machine.” *See* Ex. E (emphasis added). YourDictionary similarly defines a unit as “A group regarded as a distinct entity within a larger group” or “An entire apparatus or the *equipment that performs a specific function.*” *See* Ex. F (emphasis added). None of the emphasized definitions required “units” to be “physically distinct.” Indeed, they are entirely consistent with the language of the asserted claims, which require an “LPHDR execution unit

adapted to to execute a first operation on a first input signal ... to produce a first output signal”
 ’156 Claim 1.

Google fares no better with the more specific term “execution unit. The definitions of “execution unit” or even “processing element” in computing do not specify any requirement for physical distinctiveness from other such units. An execution unit is often described as a part of a CPU that performs operations or calculations; it may have internal components such as registers and sub-units like GPUs, ALUs or FPUs, but there is no mention in definitions of an execution unit needing to be physically distinct from other execution units. *See* Exs. G-H. Similarly, a processing element is defined as a hardware element that executes instructions, performs arithmetic and logic operations, and can change the order of operations based on stored information; this term is generic and context-dependent, and while it indicates that each processing element generates a single output (like the output of a reduced precision operation in the patent), the definitions do not mention any requirement of a processing element being physically separate from other processing elements. *See* Ex. I (“A generic term used to reference a hardware element that executes a stream of instructions. The context defines what unit of hardware is considered a processing element.”); Ex. J (“Each *processing element*, called as neuron, has a single output and performs an activation function of the weighted sum of all its inputs”. Each *processing element* generates a single output that is transmitted to the other *processing element*.”). In summary, while execution units and processing elements are functionally individual components within the broader architecture of CPUs or systems on a chip, the requirement for them to be physically distinct from one another is not a stipulation found in the definitions from computer dictionaries or encyclopedic sources.

2. Nothing in the Claims or Specification Require “Physically Distinct”

Courts must be careful to “us[e] the specification [only] to interpret the meaning of a claim” and not to “import[] limitations from the specification into the claim.” *Phillips v. AWH*, 415 F.3d at 1323.

Nowhere in the specification (or the claims) did Dr. Bates exclude from the scope of his inventions devices having execution units that are not “physically distinct.” Such an exclusion would be shocking to a person of ordinary skill in the art since it would preclude the sharing of resources across execution units adapted to to perform the claimed low precision high dynamic range operations, where the specification explicitly contemplates the sharing of resources when designing execution units. For example, the specification teaches that “shared circuitry” and “[a]ny such method, or other method” may be used for reduced precision (*i.e.* LPHDR) processing to allow for “minimal use of resources”:

Much of the published literature about LNS is concerned with how to compute $F(x)$, the special number for ADD, along with a similar function for SUB. *Often these two functions share circuitry*, and this is why single combined adder/subtractor 604 is used in the embodiment in FIG. 6. There are many published ways to compute these functions or approximations to them, including discussions of how to do this when the values are of low precision. Any such method, or other method, may be used. Generally speaking, the more appropriate variations for massively parallel LPHDR arithmetic are those that require the minimal use of resources, such as circuit area, taking advantage of the fact that the representation used in the embodiment of FIG. 6 is low precision and that the arithmetic operations need not be deterministic nor return the most accurate possible number within the low precision representation.

’273 patent at 13:39-54 (emphasis added); *see also* ’156 patent at 13:42-57.

Google’s proposed “physically distinct” requirement runs directly contrary to these teachings to “share[] circuitry” and to employ “the minimal use of resources, such as circuit area” when designing execution units. Accordingly, Google’s proposed new construction is legally improper. *Phillips v. AWH*, 415 F.3d at 1316 (“claims must be construed so as to be

consistent with the specification, of which they are a part.”) (citation omitted); *see also Blazer v. Best Bee Brothers LLC*, No. 2022-1033, 2022 WL 16954848, slip op. at *5 (Fed. Cir. Nov. 16, 2022) (affirming district court’s rejection of construction that would restrict claims to “separate device couplings” to the exclusion of “non-separate-device” couplings); *VR Optics, LLC v. Peloton Interactive, Inc.*, No. 2021-1900, 2023 WL 2031213, slip op. at *7 (Fed. Cir. Feb. 16, 2023) (affirming district court’s construction as consistent with the specification that did not limit the type of display that may be used); *AMP Plus, Inc. v. DMF, Inc.*, No. 2021-1595, 2022 WL 16844516, slip op. at *6 (Fed. Cir. Nov. 10, 2022) (affirming construction as consistent with the specification that did not limit the “driver” to a device that connects only to “traditional buildings that would contain a building main power source”).

Google acknowledges that the concept of “share[d] circuitry” in an execution unit to allow for “minimal use of resources” is disclosed in the specification, Mot. at 9, but argues that “the specification contains no examples of overlapping ‘execution units.’” *Id.* at 11. But there is no requirement that the specification disclose each and every possible embodiment of an execution unit. *See supra*. No burden is placed upon the applicant to list each and every possible separate combination of components in an execution unit that may be combined into a “share[d] circuit” to allow for “minimal use of resources” within an execution unit. As the Federal Circuit has repeatedly stated, such a drastic disclosure requirement is contrary to law. *See, e.g., Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1344 (Fed. Cir. 2001) (“Our case law is clear that an applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention”); *Cordis Corp. v. Medtronic AVE Inc.*, 339 F.3d 1352, 1365 (Fed. Cir. 2018). “The law does not require the impossible” in this regard. *SRI Int’l v. Matsushita Elec. Corp. of Am.*, 775 F.2d 1107, 1122 (Fed. Cir. 1985) (en banc). Accordingly, “the absence

of other embodiments is not limiting.” *See, e.g., Lyft, Inc. v. Quartz Auto Techs. LLC*, No. 21-cv-01871, 2022 WL 19975246, at *10 (N.D. Cal. Nov. 3, 2022) (citing *Rexnord v. Laitram*, 274 F.3d at 1344). In view of the specification’s teachings described above, Google’s proposed new construction to limit the scope of the claims should be rejected as contrary to law.

Google argues that overlapping processing elements are inconsistent with the “exceeds” limitation, arguing that “once a single component can be included within multiple execution units (LPHDR or 32-bit), there is no principled basis for defining the precise “units” in a specific circuit, let alone a principled way of comparing their number to that of another set of units as is required by the exceeds limitation.” Mot. at 12-15. But there is such a principled way of comparing such numbers and it begins with the words of the claims themselves. LPHDR “execution units,” *by the very wording of the claims in suit*, are units adapted to execute a first *reduced-precision* operation (*i.e.*, “at least one... LPHDR execution unit adapted to execute a first operation... wherein ... for at least $X=5\%$ of the possible valid inputs to the first operation, the numerical values represented by the output signal ... differs by at least $Y=0.05\%$ from the result of an exact mathematical calculation of the first operation on ... that same input”). One can compare the number of such units the number of other units by counting the number of reduced precision outputs generated by the accused product, *precisely as required by the wording of the claims*, and also in keeping with the plain and ordinary meaning of “execution unit” *as set out in computer dictionaries and encyclopedic sources. See infra*. Google’s own documents confirm that the accused products execute [REDACTED]



See Ex. K.

Google also argues that dependent claims’ use of the word “connected” prevents the processing elements from sharing circuitry. Mot. at 15-16. Google’s myopic view of connections is, at best, misguided on several grounds. The *asserted* claims do not recite that the execution units have to be located remotely from each other and “connected” via intervening paths. And Google points to nothing in the dependent claims that requires the scope of the *asserted* claims to exclude structures that are not allegedly “physically distinct.” After all, it is possible to connect parts of execution units together even if other parts of those execution units share circuitry. As set forth above, Google’s argument is impermissible as a matter of law. *See, e.g., K-2 Corp. v. Salomon*, 191 F.3d at 1364 (“Courts do not rewrite claims; instead, [courts] give effect to the terms chosen by the patentee”).

Google also implausibly argues that Dr. Bates’s “massively parallel” use of LPHDR execution units means that the units cannot overlap because “parallel lines never intersect.” Mot. at 16-17. The illogic in Google’s leap from “massive parellism” in a computer³ to parallel lines

³ *See, e.g., Ex. L* (“**Massively parallel** is the term for using a large number of computer processors (or separate computers) to simultaneously perform a set of coordinated computations

that never intersect, speaks for itself. Critically, there is *no such limitation* in the asserted claims. The specification clearly states that the configurations shown in figures 1-6 are merely examples of the structures that can be used to practice the invention. *See* '156 patent at 2:43-57 (“Fig. 2 is an example of the Processing Element array . . .” etc.). As the Federal Circuit has repeatedly stated, courts must be careful to “us[e] the specification [only] to interpret the meaning of a claim” and not to “import[] limitations from the specification into the claim.” *Phillips v. AWH*, 415 F.3d at 1323. Thus, the Federal Circuit has “expressly rejected the contention” that the claims must be limited to the embodiments disclosed in the specification. *Id.*

3. Google’s Own Prior Art Relies on the Court’s Current Claim Construction and is Inconsistent with Google’s New “Physically Distinct” Limitation

One of Google’s invalidity arguments is explicitly based upon overlapping execution units that share resources, as explained by Dr. Miriam Leeser, Google’s expert witness. At her deposition, Dr. Leeser argued that her allegedly anticipating prior art “VFLOAT C2 System” included 61 “LPHDR execution units,” each of which included both a “multiplier” and a paired SRAM “memory circuit”:

Q. . . . You’re arguing that the execution unit, which the court has construed to mean processing element comprising an arithmetic circuit paired with a memory circuit, is met by the C2 multiplier which includes the arithmetic circuit and the SRAM that’s hanging off the data bus, correct?

[Objection]

A. I would say I think that’s correct.

in parallel”); *see also* Ex. M, p. 650 (“to have the opportunity for massive parallelism in SIMD there must be massive amounts of data, or data parallelism. SIMD is at its weakest in case statements, where each execution unit must perform a different operation on its data, depending on what data it has.”); Ex. N, p. 191 (defining “parallel computer” as “A computer that is capable of *parallel processing.”).

See Ex. O at pp. 151:22-152:7. Dr. Leeser testified that the VFLOAT system had 61 distinct “multipliers” (*id.* at 33:11-15) but admitted that they all share a SRAM⁴ memory circuit. *Id.* at 150:10-24; 151:22-152:7. Thus, when arguing for invalidity, Google recognizes that multiple “execution units” can share a common component (the SRAM memory circuit) and thereby overlap.

4. The Extrinsic Evidence Fails to Support’s Google’s New “Physically Distinct” Limitation

Google’s arguments regarding the extrinsic evidence also fail. Google has not produced a *single* piece of evidence that defines *even so much as a unit* (let alone an “execution unit”) as being non-overlapping (“physically distinct”) relative to another unit.

To the contrary, the art is replete with examples of execution units that share resources and/or overlap with one another. In fact, many can be found in the documents that have been produced in this case alone. As discussed above, Leeser’s alleged prior art VFLOAT system has execution units comprising 61 arithmetic circuits that share an SRAM memory circuit.

Another example is Google’s own U.S. Patent Application No. US 2018/0336165 A1. See Ex. P. The inventors named on this Google patent include some of the chief architects of the accused products, including Andrew Phelps, who was exposed to Singular’s patented technology via Dr. Bates’s presentations at Google before the accused Google products were even designed.

The patent states that 1,024 Vector Processing Units all share a pseudo-random number generator, PSRNG 118, that is used to generate pseudo-random numbers that can be used by those 1,024 execution units to “accomplish a certain operation associated with vector arithmetic.” See *id.* at 8:16-22; 9:37-45; 12:34-44. The patent further describes an “*extended*

⁴ “SRAM” is the acronym for “static random-access memory.”

vector unit” comprising four parts of the VPU (*i.e.*, the scalar memory, the vector memory, the scalar processor and the vector registers) *and in addition*, the MXU (which contains the 128 by 128 array of multipliers that are each part of an LPHDR execution units), the transpose unit, and the reduction and permutation unit:

FIG. 1B shows a high-level example of compute core (101). The compute core can be a machine, *i.e.*, a VLIW machine, that controls several compute units in parallel. Each compute core (101) contains: a scalar memory (104), a vector memory (108), a scalar processor (107), vector registers (106), and extended vector units (*i.e.*, a matrix multiply unit (MXU) (113), a transpose unit (XU), and a reduction and permutation unit (RPU) (116)).

Id. at 3, ¶ [0036]. This is illustrated in Figure 1B of the application:

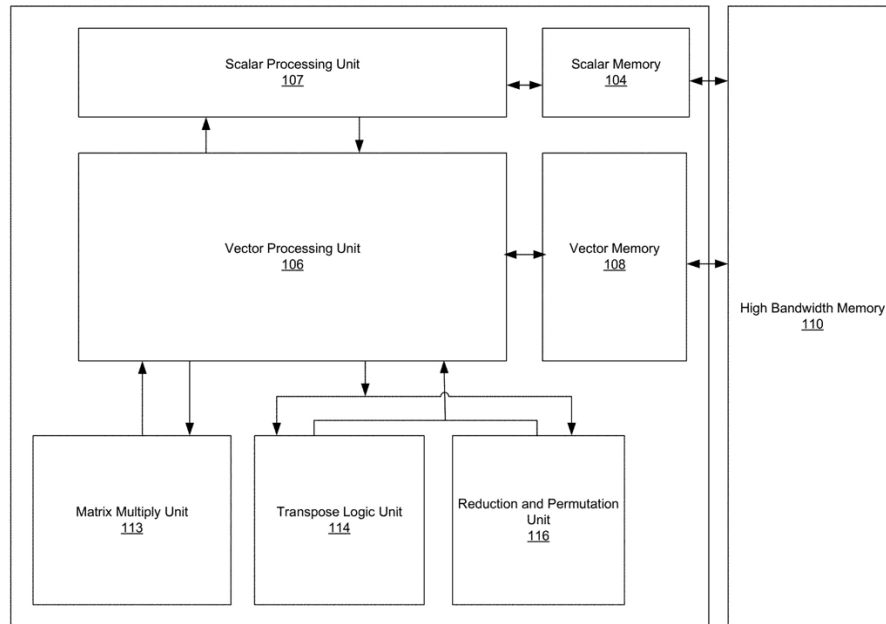


FIG. 1B

Id. at Sheet 2. This is the type of overlap in units that Google seeks to define away with its new “physically distinct” claim construction.

In short, under its plain and ordinary meaning, and consistent with the language of the claims and the specification and the extrinsic evidence, an “execution unit,” or indeed any sort of computing “unit,” cannot be limited to being “physically distinct” as proposed by Google.

IV. CONCLUSION

For the reasons set forth above, Google's eve-of-trial motion for further claim construction should be denied.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that, on November 13, 2023, all counsel of record who have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system.

/s/ Kevin Gannon